Federal Communications Commission

FCC 96-426

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 25 of the Commission's Rules to Establish Rules and Policies Pertaining to the Second Processing Round of the Non-Voice, Non-Geostationary Mobile Satellite Service	)	IB Docket No. 96-220

NOTICE OF PROPOSED RULE MAKING

Adopted: October 29, 1996 **Released:** October 29, 1996

Comment Date: November 29, 1996
Reply Comment Date: December 16, 1996

By the Commission:

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I. INTRODUCTION

1. By this Notice, we take the next step toward licensing systems in the second processing round for the non-voice, non-geostationary mobile satellite service ("NVNG MSS"). This service, also referred to as the "Little LEO" satellite service, uses constellations of low-Earth orbiting ("LEO") satellites to provide commercial radio location and two-way data

messaging services to potential customers anywhere in the world. It is Commission policy to attempt to provide spectrum to as many applicants as possible in order to increase competition and the provision of service to the public. In this Notice, we propose rules and policies that will allow us to increase competition and bring new services to market as quickly as possible.

2. This Commission has already licensed three Little LEO systems to serve the United States. We believe that adding more systems will enhance competition and will lead to lower prices and increased service options for customers. Therefore, in this second processing round, we propose rules that would limit eligibility to new entrants in the service. If we do not have sufficient spectrum to accommodate all qualified applicants, we seek comment on whether we should conduct an auction to select licensees from mutually exclusive applicants.

II. BACKGROUND

3. Little LEO satellite systems allow customers to use small, inexpensive user transceivers to communicate with satellites operating at altitudes much lower than those in geostationary satellite orbits. The lower altitudes improve signal quality and reduce the time delay of the transmission. Because they are operating in non-geostationary satellite orbits, each satellite in the constellation appears to be moving. In other words, a particular satellite, as it orbits the Earth, will appear above the horizon, move across the sky, and disappear below the horizon. User transceivers are capable of tracking the satellite and picking up another satellite as it comes into view.

4. Constellations of Little LEO satellites are capable of providing two-way data services, including position location services, anywhere in the world. The myriad of potential applications for this service include emergency location service to remote areas, environmental data collection, vehicle tracking, and time-sensitive business and personal data communications.

5. In 1990, Orbital Communications Corporation ("Orbcomm") filed an application proposing a commercial Little LEO system. Subsequently, Starsys Global Positioning, Inc. ("Starsys") and Volunteers in Technical Assistance ("VITA")[1] filed applications to be considered concurrently with Orbcomm's. These applicants, comprising the first Little LEO processing round, requested authority to operate their systems, both service and feeder links, in a variety of frequencies in the 137-138 MHz, 148-149.9 MHz, and 400.15-401 MHz frequency bands. These frequency bands were not then allocated to the Little LEO service.

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[1] VITA's request for experimental authorization on September 7, 1988, which the Commission later granted, was the first request for authorization to provide Little LEO service. See Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum for Fixed and Mobile Satellite Services for Low-Earth Orbit Satellites, Report and Order, 8 F.C.C. Rcd. 1812 (1993).

6. At the 1992 World Administrative Radio Conference ("WARC-92"), these bands including the 149.9-150.5 MHz band were allocated to the Little LEO service on a worldwide primary shared basis.[2] Consequently, Little LEO operations must be coordinated with the operations of other primary services in these bands.

7. After WARC-92, the Commission allocated these bands domestically to the Little LEO service on a primary shared basis.[3] In 1993, we adopted rules and policies for licensing the applicants in the first Little LEO processing round.[4] These rules and policies were largely drawn from a successful Negotiated Rulemaking proceeding,[5] where the applicants agreed to a framework that would allow all three systems to operate in the available spectrum. The applicants represented that their agreement would also allow us to license additional systems in these bands.[6] As a result, by the end of 1995, we had issued licenses to all three first round applicants.[7]

8. Before we took action on the first round applications, LEO One USA Corporation ("LEO One") filed an application for another Little LEO system and requested that we open a second processing round. LEO One requested authority to operate in portions of the bands allocated at WARC-92. We placed LEO One's application on public notice before we completed action on the first round to demonstrate the need for additional spectrum consistent with the

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2 World Administrative Radio Conference 1992, Torremolinos, Spain. "Primary" services have equal rights to operate in particular frequencies. Stations operating in primary services are protected against interference from stations of "secondary" services. Stations operating in a secondary service cannot claim protection from harmful interference from stations of a primary service. See 47 C.F.R. §§ 2.104(d) and 2.105(c).

3 Amendment of Section 2.106 of the Commission's Rules to allocate Spectrum to the Fixed Satellite Service and the Mobile Satellite Service for Low-Earth Orbiting Satellites, Report and Order, 8 F.C.C. Rcd. 1812 (1993).

4 Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Non-Voice, Non-geostationary Mobile Satellite Service, Report and Order, 8 F.C.C. Rcd. 8450 (1993) ("Little LEO Order").

5 Below 1 GHz LEO Negotiated Rulemaking Committee, Report, September 16, 1992.

6 Id. at 8-9; Little LEO Order at ¶ 21 and n.38.

7 Application of Orbcomm for Authority to Construct, Launch, and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System, Order and Authorization, 9 F.C.C. Rcd. 6476 (1994) ("Orbcomm Authorization"), recon. 10 F.C.C. Rcd. 7801 (1995); Application of Starsys for Authority to Construct, Launch, and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System, Order and Authorization, 11 F.C.C. Rcd. 1237 (1995) ("Starsys Authorization"); Application of VITA for Authority to Construct, Launch, and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System, Order and Authorization, 11 F.C.C. Rcd. 1358 (1995) ("VITA Authorization").

United States' position seeking additional spectrum for the Little LEO service at the 1995 World Radio Conference (WRC-95).[8] In the Public Notice, we established a cut-off date for filing applications to be considered concurrently with the LEO One application. In response, four entities submitted applications for new Little LEO systems. They were CTA Commercial Systems, E-Sat, Inc., Final Analysis Communication Service, Inc. ("FACS"), and GE American Communications, Inc. ("GE Americom"). Two first round licensees, VITA and Orbcomm, in the second processing round, submitted modifications to their licensed systems to use additional service bands within the WARC-92 allocation.[9] Additionally, Starsys had filed an amendment on April 25, 1994, after the cut-off date for filing applications in the first processing round, proposing use of additional service bands within the WRC-92 allocations. We deemed Starsys's filing to be a "major amendment" and deferred its request to the second processing round.[10] Consequently, all three first round licensees are also applicants in the second processing round. Thus, eight applicants are in the second processing round.

9. In this Notice, we propose rules for licensing these applicants. These include rules that would limit eligibility in the second round to new applicants, specifically, those who are not already a licensee or affiliated with a licensee. Even with limited eligibility, however, it is possible that there will not be spectrum sufficient to accommodate all applicants. Thus far, applicants have failed to negotiate sharing arrangements. If mutual exclusivity occurs between qualified applicants, we ask for comment on whether we should conduct an auction.

III. DISCUSSION

10. One of the Commission's primary objectives is to create a regulatory environment facilitating the provision of efficient, innovative, and cost-effective satellite communications services in the United States.[11] We have sought to do so by promoting fair and vigorous competition in the satellite communications market and by inhibiting "warehousing" of spectrum by those who will not use it at the expense of those who will. Toward this end, we have

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[8] We placed LEO One's application on public notice on September 16, 1994 prior to granting the first Little LEO license on October 20, 1994, the second on July 21, 1995, and the third on November 13, 1995. See Satellite Application Acceptable for Filing Cut-off Established for Additional Applications, Public Notice, Report No. DS-1459 (September 16, 1994). The Public Notice also solicited applications for systems to operate inter-satellite links in the 22.55-23.55 GHz and the 24.45-24.75 GHz frequency bands.

[9] Non-voice Non-geostationary Low Earth Orbit Satellite Applications accepted for Filing, Public Notice, Report No. DS-1484 (November 25, 1994).

[10] See Starsys Authorization at ¶¶ 19 and 21.

[11] See 47 U.S.C. § 151.

adopted rules in particular satellite services to encourage entry by qualified applicants and to give operators maximum flexibility to tailor their offerings to meet their customers' requirements.[12] This "Open Skies" policy has enabled the United States to lead the world in developing and implementing satellite technology. In this second Little LEO processing round, we similarly seek to foster a climate that maximizes competition and promotes multiple entry to the benefit of the United States public.

A. Eligibility for the Second Round

1. New Entrant Proposal

11. In light of the Commission's goal of promoting multiple entry and competition, we propose to award licenses only to new entrants in the second Little LEO processing round. This will enhance competition by allowing additional Little LEO satellite service providers to enter the marketplace.

12. We propose to exclude current licensees from participating in this proceeding because competition in the Little LEO marketplace may be limited if an existing licensee obtains additional spectrum thereby excluding a new licensee from entering the Little LEO market. Once we have granted licenses in this proceeding, there will not be sufficient spectrum to support additional Little LEO systems in the U.S. market. Therefore, in order to promote competition in the Little LEO market, we propose to maximize entrants.

13. We propose to define a "new entrant" as a pending applicant who is not a Little LEO licensee or an affiliate of a Little LEO licensee. We propose to identify any individual or entity as an affiliate if such an individual or entity: (1) directly or indirectly controls or influences a licensee; (2) is directly or indirectly controlled or influenced by a licensee; or (3) is directly or indirectly controlled or influenced by a third party or parties that also has the power to control or influence a licensee. We seek comment on this proposal.

14. Where a licensee is affiliated with one of its competitors, neither company has as strong an incentive to compete vigorously against its partner as it does with respect to an unrelated competitor. A company that is entitled to a substantial percentage of the profit generated by its competitor will be reluctant to undercut the competitor's price. Doing so would amount to taking money out of its own pocket. Rather than compete on price, both companies

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[12] See, e.g., Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Band, 9 F.C.C. Rcd. 5936 (1994) ("Big LEO Order"); Policies and Procedures for Licensing of Space and Earth Stations in the Radiodetermination Satellite Service, 104 FCC.2d 650 (1986) ("RDSS Order").

have an incentive to maintain a high price level and maximize joint profits or returns by coordinated interaction.

15. Partial ownership interests can create the very non-competitive markets that we want to avoid.[13] Even silent financial interests -- i.e., non-controlling shares or equity interests -- may affect the behavior of the partly owned company by causing the minority owner to take into account its behavior on the profits of its partly owned competitor. A minority shareholder would have an incentive to stifle vigorous price competition. It would also have the capability to do so, because a minority owner may exert influence over the company by challenging various business decisions, by conducting (or even just threatening) litigation, by refusing to provide additional capital, by insisting upon business audits, or by using other mechanisms by which minority owners protect their investments in closely held firms.

16. Thus, we propose to adopt rules that attribute to the holder any interest of five percent or more, whether voting or nonvoting, and partnership interests whether general or limited. This is consistent with other ownership thresholds the Commission has applied to other licensees.[14] In addition, we propose to adopt attribution rules that: (1) attribute any interest of ten percent or more held by an institutional investor or investment company, rather than a five percent interest; (2) employ a multiplier for determining attribution of interests held through intervening entities; (3) provide for attribution of interests held in trust; (4) attribute the positional interests of officers and directors; (5) attribute limited partner interests based not only upon equity but also upon percentages of distributions of profits and losses; and (6) provide for attribution based upon certain management, joint marketing, and joint operating agreements. We seek comment on whether other positional interests should be deemed cognizable interests for purposes of application of spectrum limitations and whether we should attribute debt or unexercised convertible interests or insulated limited partnership interests to their holders. We seek comment on these proposals.

17. We propose to attribute both the ability to control and the ability to influence to the holder of interest in the entity. These two concerns have long driven attribution policies in the

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[13] Joseph Farrell & Carl Shapiro, Asset Ownership and Market Structure in Oligopoly, 21 RAND Journal of Economics 275, 285 (1990).

[14] See, e.g., Review of the Commission's Regulations governing Attribution of Broadcast Interests, 10 F.C.C. Rcd. 3606 (1995); Amendment of the Commission's Rules to Establish New Personal Communications Services, 9 F.C.C. Rcd 4957, ¶¶ 105-122 (1994); Reexamination of the Commission's Rules and Policies Regarding the Attribution of Ownership Interests in Broadcast, Cable Television and Newspaper Entities, 97 FCC.2d 997 (1984), recon. granted in part, 58 R.R.2d 604 (1985), clarification, 1 F.C.C. Rcd. 802 (1986); Revision of Rules and Policies for the Direct Broadcast Satellite Service, FCC 95-507, IB Docket No. 95-168, ¶¶ 85-97 (released December 15, 1995) ("DBS Order").

mass media context and we believe these concerns are also appropriate in the context of Little LEOs. Control and influence can be conferred or exercised over management operation, decision making, and market conduct in the absence of ownership interests that confer *de jure* control. As in the context of the Commission's rules in other communications services, "control" means not only majority equity ownership, but includes any general partnership interest or any means of actual working control over the operation of the licensee in whatever manner exercised. Influence has been viewed as an "interest that is less than controlling, but through which the holder is likely to induce a licensee or permittee to take action to protect the investment."[15] We propose to rely on existing case law for making control[16] and influence determinations where such issues arise. We request comment on whether we should attribute the ability to control or the ability to influence or both to the holder of the interest.

18. If we adopt a rule limiting eligibility to new entrants, we will dismiss all applicants who do not meet this criterion when the rule becomes effective. To ensure that competition continues to flourish once the license has been granted, we ask for comment on whether we should adopt rules or polices to ensure that control of a license is not transferred or assigned to a first round licensee or its affiliate. If, however, we secure additional spectrum allocations for the Little LEO mobile satellite service at a future World Radio Conference, we shall consider allowing existing licensees to be eligible to use this spectrum if they can demonstrate the need for additional capacity to meet customer demand. These licensees, by that time, should be operating established systems in a competitive environment. We expect to request further comment on this analysis if and when we open a third processing round.

a. Rationale

19. The foregoing proposed service rules are structural solutions designed to promote competition by maximizing the number of providers.

i. Multiple Entry and Competition Policy

20. In the market for the services provided by Little LEOs, as in the markets for all services provided by satellites, the Commission seeks to ensure that the public receives a great array of choices, innovative services, and low prices. In order to achieve these objectives, the

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[15] See Intermountain Microwave, 24 Rad. Reg. (P&F) 983 (1963). Review of the Commission's Regulations Governing Attribution of Broadcast Interests, Notice of Proposed Rule Making, 10 F.C.C. Rcd. 3606, ¶ 4 (1994).

[16] See, e.g., WWIZ Inc., 36 F.C.C. 561 (1964), aff'd sub nom. Lorain Journal Co. v. FCC, 351 F.2d 824 (D.C. Cir. 1965), cert denied 383 U.S. 967 (1966).

Commission has encouraged multiple entry and competition.[17] Thus, applicants arguing against our proposal to limit second round applicants to new entrants must persuade the Commission that consumer benefits from other factors, such as economies of scale and scope outweigh the benefits of increasing competition.

ii. Market Analysis

21. To confirm our tentative conclusion that we should exclude first round licensees from the second round, we propose to use the structure-conduct-performance (SCP) paradigm of modern industrial organization.[18] This analysis will allow us to understand more fully how the market would perform if there were only three Little LEO satellite systems versus how it would perform if there were four, five or six systems. The SCP model measures the *performance* of a market by first defining the *basic conditions* and *structure* of that market, and then by evaluating the *conduct* of suppliers and consumers within the structural framework of that market. If a market is performing well, consumers should benefit from, among other things, lower and more stable prices, more services, and technical innovation.

22. We request comment regarding the general approach to our analysis as well as: (a) the basic conditions of the Little LEO market; (b) the structure of this market under the two scenarios; (c) the likely conduct of firms within these alternate structures; and (d) the potential market performance which might be expected to result under each scenario.

iii. Basic Conditions

23. In analyzing basic market conditions, we propose, to examine the characteristics of consumer demand for Little LEO services, such as the willingness of consumers to substitute Little LEO services for other services and other factors that would make demand more or less elastic. We also propose to examine the characteristics of supply, such as suppliers' cost structures and other factors that would make supply more or less elastic. Elasticity of demand and elasticity of supply are components of a well-performing market since they indicate

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[17] See, e.g., RDSS Order; Big LEO Order; Little LEO Order.

[18] The SCP paradigm is a well-accepted methodology under modern industrial organization economics. See F.M. Scherer and David Ross, Industrial Market Structure and Economic Performance 4-7 (3rd ed. 1990) ("Scherer & Ross"); Dennis W. Carlton & Jeffrey M. Perloff, Modern Industrial 2-4 Organization (2d ed. 1994). The Commission has used this analysis in a variety of contexts to help guide its policy decisions. See, e.g., In re Petition of the Connecticut Department of Public Utility Control, 10 F.C.C. Rcd. 7025, ¶ 18 (1995); In re Petition of the State of California, 10 F.C.C. Rcd. 7486, ¶ 28 (1995); In re Implementation of Section 19 of the Cable Television Consumer Protection and Competition Act of 1992, Annual Assessment of the Status of Competition in the Market for Delivery of Video Programming, 9 F.C.C. Rcd. 7442, Appendix H (1994).

consumer and supplier responsiveness to price changes.

24. As we stated above, Little LEO systems have the potential to provide low-cost, commercial radio location and two-way data messaging ("CRL-TWDM") services anywhere in the world using small, inexpensive transceivers. These systems will allow subscribers to send and receive short data messages to and from locations. Ultimately, Little LEO systems may be used to provide a number of diverse services, including emergency location services in remote areas, environmental data collection, vehicle tracking and monitoring, and time-sensitive business and personal data. The market for these CRL-TWDM services is the subject of our analysis. Suppliers may include Little LEOs or others.

25. *Demand.* Potential consumers for these services include transportation and shipping companies (for mobile messaging and location); business travelers, and business and public safety organizations with locations in remote sites (for paging, e-mail, and mobile computing); factories, utilities, and agricultural concerns (for data acquisition, monitoring, and control including reading meters and sensors); businesses and residences (for alarm messages); hikers and skiers (for emergency notification and location messages); and retailers (for retail point-of-sale reporting, credit card validations, ATM reporting, direct-to-home TV shopping).

26. As with many consumer services, the more consumers can switch to substitutes for Little LEO services when prices increase, the more incentive suppliers have to compete to attract and keep customers.[19] There may be other services that could be substitutes for CRL-TWDM services. We request comment on the prevalence of substitutes for Little LEO service and the costs of switching suppliers and other characteristics of demand.

27. *Supply.* In our analysis of basic market conditions, we must also explore whether CRL-TWDM services themselves (as opposed to substitutes for them) may be provided by suppliers other than Little LEOs. Big LEO systems, for example, can also provide two-way, worldwide, mobile data services. Several other service providers can provide similar services as well. Operators of any of the more than thirty U.S.-licensed geostationary orbit ("GSO") fixed-satellites can provide nationwide or regional fixed-data services. Also, AMSC Corporation, which is operating a GSO mobile-satellite, and terrestrial service providers, such as personal communications service ("PCS") providers, provide two-way mobile data services in the United States. We request comment on whether these or other suppliers can be considered suppliers of CRL-TWDM services.

28. Even if there are alternative suppliers, however, they may be unable to provide the

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[19] See In re Motion of AT&T Corp. to be Reclassified as a Non-Dominant Carrier, 11 F.C.C. Rcd. 3271, ¶¶ 63-66 (1995).

entire range of CRL-TWDM services at a cost comparable to that estimated by the Little LEO applicants. We request comment as well on the implication of the assertion by some applicants that Little LEOs provide service at a lower price than non-Little LEO suppliers of the same services. If the incremental cost of service provision is lower for Little LEOs than for non-Little LEOs, then, even if there are non-Little LEO suppliers of CRL-TWDM, the entry of additional Little LEO systems would increase competition by increasing significantly the number of suppliers with those lower prices. In their analyses, commenters should consider the cost of providing these services since the cost structure of provision of Little LEO services has significant implications for economies of scale and the benefits to competition.

29. We also request comment on the existence of barriers to entry. Depending on the existence and type of non-Little LEO suppliers of CRL-TWDM service, barriers to entry for potential suppliers may be very high if the relevant market for analysis is only Little LEOs (i.e., there are no close substitutes or other suppliers). If, however, suppliers of Little LEO service include PCS companies or other satellite systems, then barriers to entry may be somewhat lower. We ask parties to comment on the existence of barriers to entry. We also ask that if there are in fact, barriers to entry, whether there is something the Commission can do to lower those barriers.

iv. Market Structure

30. Once we have defined the basic conditions of the market, we can analyze the structure of that market by examining the number and size of consumers and suppliers and any economies of scale and scope that might pertain to a specific supplier's cost structure.

31. First round licensees argue that benefits from economies of scale and scope outweigh the benefits from additional competition. For example, Orbcomm argues that permitting it additional spectrum, will improve system design and reliability, with a result of better service to the public.[20] We seek comment on the presence of economies of scale and scope and whether granting expansion capacity to existing licensees would create significant benefits as a result of such economies. We ask if there are other ways to get those same efficiencies, such as through capacity sharing.

32. We request comment on other factors influencing cost of providing service.

v. Conduct

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[20] Orbcomm Application for Modification of License to Construct, Launch, and Operate a Non-voice, Non-geostationary Mobile Satellite System, File No. 28-SAT-MP/ML-95, Consolidated Response of Orbcomm at 2, (dated April 10, 1995).

33. The market structure will suggest certain possibilities for the conduct of consumers and suppliers in the market, including tacit or overt cooperation among sellers. The extent to which firms will tend to compete on price or service will depend in part on the number of relevant suppliers (competitors) and the number of substitutes. If there are only three competitors -- namely, the three Little LEO systems -- competition will likely be less than if Little LEO systems compete with non-Little LEOs for provision of the same or substitute services. We seek comment on potential issues of conduct.

vi. Performance

34. To inform our final decision on whether to adopt rules to increase the number of Little LEO operators, we propose to compare how the market would perform -- and therefore the benefits it would provide to consumers -- under a scenario in which there were three Little LEO systems versus how it would perform under a scenario in which there were four, five or six Little LEO systems.[21] We seek comment on the performance that will result under each scenario, given the basic conditions, market structure, and conduct in the relevant market.

35. We tentatively conclude that if Little LEOs operate using a lower-cost technology than non-Little LEO suppliers of Little LEO services, then performance will be enhanced by the entry of new suppliers even in the presence of substitute or non-Little LEO suppliers. In this case, one, two or three new suppliers will be added to the three existing suppliers at the lower cost and will increase competition in the market overall. In the case where there are no other suppliers or very few, the addition of up to three suppliers would similarly enhance performance. In either case the benefits to consumers would likely outweigh any cost in terms of lost economies of scale. We seek comment on this tentative conclusion.

vii. Effect on First Round Licensees

36. We licensed all three first round applicants on the basis of the sharing proposal they advanced in the Negotiated Rulemaking. Significantly, our approval of that sharing proposal rested on a promise that future entrants could be licensed in the allocated spectrum. In the Little LEO Order, we noted that "[s]ome unassigned NVNG spectrum remains available under the applicants' sharing proposal" and that "[b]oth Orbcomm and Starsys continue to assert their

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[21] Under well-established precedent, this Commission may analyze imminent future competition based upon current market conditions in its decision-making. See Connecticut Department of Public Utility control v. FCC, 78 F.3d 842 (2d Cir. 1996) (Connecticut PUC v. FCC); Petition of the People of the State of California and Public Utilities Commission of the State of California to Retain Regulatory Authority Over Wholesale Cellular Service Providers in the State of California, 10 F.C.C. Rcd. 7486 at ¶ 22 and n.60 (1995) (California Cellular Petition), recon. denied 11 F.C.C. Rcd. 796 (1995).

abilities to share their proposed service link frequencies with future systems."[22] In fact, we did not place spectrum or power limits on the three licensees, as proposed by a party interested in filing a second round application, because we believed that the licensees would be able to coordinate their operations successfully with future Little LEO systems.[23] We indicated, however, that we would consider imposing spectrum limitations in order to permit additional entry if "service link sharing [does] not prove satisfactory."[24]

37. First-round licensees have been on notice for several years that we expected to be able to authorize additional Little LEO systems in this band. First round applicants had no reason to believe that, in addition to approving their sharing proposal, we might grant first-round licensees expansion capacity to the exclusion of new Little LEO licensed systems.

viii. Promoting Efficient Spectrum Use

38. Aside from the competitive concerns in determining eligibility to hold a second round license, we want to ensure that licensees are making full use of their assigned spectrum before they are granted expansion capacity. Currently, none of the three Little LEO licensees is operating at full capacity. Indeed, Orbcomm is the only licensee providing any service, and at present, is operating only two of its thirty-six authorized satellites. Nevertheless, all licensees have requested additional spectrum. We tentatively conclude that it is not in the public interest for this Commission to hold additional spectrum for existing licensees on the basis of speculative long-term traffic projections, if the result is to exclude qualified "new" entities who are proposing competitive alternatives.

2. Financial Qualifications

39. In light of the huge costs involved in constructing and launching a satellite system, financial ability has always been considered a significant factor in determining whether an applicant is qualified to hold a license.[25] Historically, the Commission has fashioned financial requirements for satellite services on the basis of entry opportunities in the particular service being licensed. This policy stems from our repeated experience that licensees without sufficient available resources will likely spend a significant amount of time attempting to raise the financing required to construct and launch a satellite system and these attempts will often end

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[22] Little LEO Order at ¶ 21 and n. 38.

[23] Id. at n. 38 and 39.

[24] Id. at n. 38.

[25] See, e.g., RDSS Order; Big LEO Order.

unsuccessfully.[26] As a result, in cases where there are more applicants than the spectrum can accommodate, a grant to an under-financed space station applicant may preclude a capitalized applicant from implementing its system, and delay service to the public. In these cases, we have required a stringent financial showing. Where grant to an under-financed applicant will not prevent grant of other applications, the required demonstration has been less stringent. For example, in the radiodetermination satellite service, where all applicants could be accommodated with our mandated system architecture and future entry also was possible, only a detailed business plan was required.[27] In contrast, in the domestic fixed-satellite service, where applications to implement space stations regularly exceed the number of available orbital locations for those satellites, evidence of full, irrevocable financing is required.[28]

40. Under the current financial requirement for the Little LEO service an applicant must demonstrate that it has the finances necessary to construct, launch, and operate two satellites in its system for at least one year. Given that future entry may not be possible in the Little LEO service and grant to an under-financed applicant will likely prevent a capitalized applicant from going forward, we propose to amend the current financial qualification standard to require that each applicant demonstrate that it has the finances necessary to construct, launch, and operate its entire system for a year.[29] We ask that commenters respond to this proposal and make any other relevant proposals concerning our financial standard.

B. Spectrum Sharing Proposals

41. When we established the second Little LEO processing round, we invited applications to provide service in the 148-150.5 MHz, 137-138 MHz, and 400.15-401 MHz bands.[30]

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26 See, e.g., National Exchange Satellite, Inc., 7 F.C.C. Rcd. 1990 (Com. Car.Bur. 1992); Rainbow Satellite, Inc., Mimeo No. 2584 (Com. Car. Bur., released Feb. 14, 1985); United States Satellite Systems, Inc. Mimeo No. 2583 (Com. Car. Bur., released Feb. 14, 1985) (domestic satellite licenses declared null and void for failure to begin implementation as required by license). In addition, Geostar Corporation, a start-up company licensed in the radiodetermination satellite service, declared bankruptcy nearly five years after its licenses were issued. It had not built any of its satellites.

27 RDSS Order. Although Geostar Corporation declared bankruptcy eventually, it did not keep any fully capitalized companies from implementing their systems.

28 Licensing Space Stations in the Domestic Fixed-Satellite Service, FCC No. 85-395, CC Docket No. 85-135 (released August 29, 1985) ("1985 Domsat Order"); 47 C.F.R. § 25.140(c).

29 See, e.g., 1985 Domsat Order; Big LEO Order.

30 See Satellite Application Acceptable for Filing; Cut-off Established for Additional Applications, Public Notice, Report No. DS-1459 (September 16, 1994).

Portions of these bands are already licensed to Orbcomm, VITA, and Starsys.[31] We now propose to license second round applicants to operate in portions of these bands as well. In their sharing plan developed in the first round, Orbcomm, Starsys, and VITA[32] concluded that additional systems could be accommodated by using time division multiple access ("TDMA") or frequency division multiple access ("FDMA") modulation techniques and by time-sharing.[33] Although complex technical issues remain, we believe that with appropriate modulation techniques, proper system coordination, and time-sharing of frequencies, there is sufficient spectrum available to grant a license for at least one, and possibly for up to three new systems in the second processing round.

42. Specifically, we propose that one Little LEO system operate in the 149.81-149.9 MHz (uplink) and the 400.5050-400.5517 MHz (downlink) bands. We will refer to this first potential licensee as "System-1." We propose that a second Little LEO system ("System-2") operate in the 137-138 MHz band (downlink) and the 148.905-149.81 MHz band (uplink). Finally, we propose that a third Little LEO system ("System-3") operate in the 149.95-150.05 MHz band (uplink) and the 400.150-400.505 MHz and 400.645-401.000 MHz bands (downlink).[34]

43. We recognize that each of these systems will be required to operate under certain constraints. We discuss each potential system in more detail below and request comment on the viability of the proposed systems' and whether it would be technically feasible to accommodate more than one additional system in each of the band segments. Additionally, we ask whether the uplink and downlink pairings we propose are the most efficient. Parties are also asked to comment on alternative proposals and pairings. All comments should be supported with detailed technical showings on how each new system or systems can be accommodated in the proposed spectrum or in any alternative pairings. These showings should include information on appropriate modulation techniques, time-sharing scenarios including visibility statistics appropriate to each band, and system parameters (such as constellation size) that might affect

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[31] Specifically, Orbcomm is authorized to use the 148-149.9 MHz (uplink) and 137-138 MHz (downlink) frequency bands; VITA is authorized to use the 149.81-149.9 MHz (uplink) and 400.505-400.595 MHz (downlink) frequency bands; and Starsys is authorized to use the 137-138 MHz (downlink), 148-149.9 MHz (uplink) and 400.15-401 MHz (downlink) frequency bands. There are also non-U.S.-licensed Little LEO systems authorized in portions of these bands. They are described in more detail later. See infra ¶¶ 45, 49, 50, and 69.

[32] See Below 1 GHz LEO Negotiated Rulemaking Committee, Report 8-9, September 16, 1992.

[33] TDMA is a transmission technique in which the same frequency band is used by multiple earth stations transmitting in alternating time slots. FDMA provides users multiple discrete channels.

[34] We propose to allow applicants to submit amended applications to operate in any or all of these three blocks of spectrum. See infra ¶¶ 103-106.

a new entrant's ability to share successfully with existing users. Any authorization we grant would be for operations in the United States; however, in order to ensure interference-free operations with other U.S. government systems operating throughout the world, as discussed below, we propose to require the second round, Little LEO licensees to comply on a worldwide basis, with all the technical requirements, including time-sharing, that we adopt in this proceeding. Furthermore, to serve regions outside of the United States, Little LEO licensees will have to coordinate the operation of their systems with other systems operating in the proposed frequency bands in other regions of the world.

44. We note that FACS has proposed that we use their "Virtual Constellation" concept as a means of sharing the available spectrum. The Virtual Constellation concept involves licensing all applicants to operate over the entire available spectrum, with each applicant operating a small number of technically compatible satellites. Although the satellites would be independently owned and operated, there would be some joint operations to facilitate spectrum sharing. The Commission would likely sanction an agreement by all parties to participate in a Virtual Constellation, but at this time we do not propose to mandate that all applicants participate in the Virtual Constellation. We request comment on FACS's proposal.

1. Little LEO System-1 (149.81-149.9 MHz/400.5050-400.5517 MHz)

45. We propose that Little LEO System-1 use the 149.81-149.9 MHz (uplink) and 400.5050-400.5517 MHz (downlink) bands. VITA will also be operating in these frequencies.[35] Orbcomm, Starsys, and France's Little LEO system, S80-1, also plan to operate in the 148.0-149.9 MHz uplink band but will not be operating in the 149.81-149.9 MHz portion of the band. Starsys, the Department of Defense ("DoD"), and S80-1 plan to operate in the 400.15-401.0 MHz downlink band but will not be operating in the 400.5050-400.5517 MHz portions of the band. Thus, Little LEO System-1 will share frequencies with VITA and coordinate its system with all users of the 148.0-149.9 MHz and 400.15-401.0 MHz frequency bands. We believe this is possible because Orbcomm, Starsys, and VITA have represented that they can share their

[35] SatelLife, Inc. currently has an experimental authorization to operate a satellite that uses the same frequencies as those licensed to VITA. SatelLife, Inc. has been operating since 1994 and a new Little LEO entrant will likely not be launched in the these bands for at least two to four years. Therefore, SatelLife, Inc. should have ample time to conduct its experiments and terminate its operations prior to the beginning of operations by a new Little LEO licensee. Since experimental authorizations are granted on a non-interference basis to licensed operations, we will require Satellife, Inc. to terminate its operations prior to the launch of any satellite by a new licensee in these bands. See SatelLife, Inc. Experimental Radio Station Construction Permit and License, Call Sign KS2XDT, File No. 4892-EX-PL-95 (effective September 20, 1995).

assigned service link frequencies with at least one other system.[36]

46. At least one additional Little LEO system can operate in the same frequency bands with the VITA system on a time-sharing[37] basis using TDMA/FDMA modulation techniques. VITA is authorized to operate a one-satellite system only.[38] This satellite will only be visible to users a small percentage of the time and visibility will be affected by the users location. A user located at the equator will be able to "see" VITA's one satellite approximately 3.7 percent of the time.[39] To users located at 40 and at 80 degrees latitude, VITA's satellite will be visible for 5 and 13.8 percent of the time, respectively.

47. The time when VITA's satellite is not visible can be used by Little LEO System-1. For example, a user at the equator will have access to Little LEO System-1 for over 96 percent of the time, or approximately 23 hours out of a 24 hour period. Consequently, allowing this band to remain unused for as much as 23 hours each day would not only be spectrally inefficient, but would also deny the public valuable services, inhibit further development within the mobile satellite industry, and ignore the technical advancement that makes time-sharing possible.

48. Below we discuss time-sharing techniques that may be used for Little LEO Systems 2 and 3 and the National Oceanic and Atmospheric Administration ("NOAA") and DoD, respectively.[40] Similar arrangements may be necessary in order for Little LEO System-1 to time-share with VITA. However, we do not propose any specific time-sharing requirements, and instead, will allow VITA and Little LEO System-1 the flexibility to make the arrangements necessary to ensure interference free operations. If VITA or any other party believes that such arrangements need to be codified in a rule or discussed in further detail in this proceeding, we request that the party provide detailed discussion of the issues and any proposed rules in their comments.

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36 See infra ¶¶ 36-37. Orbcomm and Starsys, however, have indicated that they could not share gateway frequencies with other systems. See Below 1 GHz LEO Negotiated Rulemaking Committee, Report 5-7, September 16, 1992.

37 Time-sharing is a new and revolutionary process that has not yet been attempted. However, given the scarcity of spectrum and its potential to maximize spectrum use, we believe time-sharing is a realistic proposal for utilizing the spectrum.

38 See VITA Authorization.

39 This calculation is based on a VITA satellite operating at an elevation angle of 0 degrees, an altitude of 800 km and an orbital inclination of 99 degrees.

40 See infra ¶¶ 49-77.

2. Little LEO System-2 (148.905-149.81 MHz/137-138 MHz)

49. The spectrum we are proposing to authorize for use by Little LEO System-2 is the 148.905-149.81 MHz band for uplinks and a number of sub-bands of the 137-138 MHz band for downlinks. Orbcomm and Starsys are authorized to use the 148.0-149.9 MHz uplink band. Orbcomm's system, however, is the only system that is coordinated to use the 148.905-149.81 MHz frequency band. Meteorological satellites ("MetSats") operated by NOAA in addition to Orbcomm and Starsys are authorized to use the 137-138 MHz downlink band. Also, METEOR, a meteorological satellite system, is authorized by Russia and the S80-1 Little LEO system is authorized by France to operate in the 137-138 MHz band.

50. Furthermore, NOAA has an agreement with the European Meteorological Satellite Organization ("Eumetsat") for the operation of a polar orbiting meteorological satellite in conjunction with NOAA's system in the 137-138 MHz band. The Eumetsat satellite may begin operations at 137.025-137.175 MHz and 137.825-138 MHz as early as 1998. In addition, DoD is expected to merge its system which will operate in the 400.15-401.0 MHz frequency band with NOAA's system. Beginning in 1998, NOAA will be responsible for "on orbit" operations of the DoD metsat satellites, and NOAA will assume all command and control functions for the DoD system by 2007. Our use of the terms "NOAA" and "DOD" in this Notice incorporates the separate systems operated by NOAA and DoD as well as the systems resulting from agreements with Eumetsat and the merger of the NOAA and DoD systems.

a. Uplink Band

51. With respect to our proposed uplink band for Little LEO System-2, Orbcomm, VITA, and Starsys are authorized to operate in the 148.0-149.9 MHz band. We believe the 148.905-149.81 MHz portion of this band can be used for Little LEO System-2 uplinks. This uplink band segment does not include frequencies coordinated for use by the French S80-1 system, Starsys, and VITA and the frequencies we have proposed that Little LEO System-1 use. In addition, NOAA indicated that they have tracking and command functions at 148.56 MHz for their polar orbiting spacecraft. Therefore, a Little LEO System-2 entrant would be required to share frequencies with Orbcomm and coordinate its system with the other users of the 148.0-149.9 MHz band to ensure interference free operations. As noted above, Orbcomm, Starsys, and VITA have represented that they can share their assigned frequencies with at least one other system.[41] We request comment on accommodating an additional entrant or entrants. To the extent that more than one new entrant can be accommodated in this band, we seek comment on methodologies for sharing this band and coordinating with existing users.

[41] See infra ¶ 36-37.

b. Downlink Band

i. NOAA's Use of the Band

52. With respect to our proposed downlink band, Footnote US318 of the Table of Frequency Allocations, 47 C.F.R. § 2.106, reserves the 137.333-137.367 MHz, 137.485-137.515 MHz, 137.605-137.635 MHz, and 137.753-137.787 MHz sub-bands ("NOAA channels") for use by Government satellite operations on a primary basis. Non-Government MSS use in these NOAA channels is secondary until January 2000. After that date, Government and non-Government use of the NOAA channels will be on a co-primary basis. The NOAA channels are currently used by NOAA for a two satellite MetSat system. The 137.025-137.175 MHz and 137.825-138 MHz sub-bands ("NOAA bands") are allocated to MSS on a secondary basis[42] and are not currently being used by Government satellite systems.[43] Our understanding is that NOAA plans to implement MetSat operations in the NOAA bands between 2003 and 2006. NOAA's system currently is composed of two satellites but, for a period of time, could consist of up to five satellites.[44] NOAA is expected to implement three new satellites in the NOAA bands and continue to operate its existing two satellites in the NOAA channels until the satellites become inoperable.

53. Furthermore, NOAA and Orbcomm have been coordinating Orbcomm's use of the 137-138 MHz band. In order to ensure that Orbcomm does not cause interference to the NOAA system when it begins operation in the 137.025-137.175 MHz band-edge sub-band,[45] Orbcomm will have to migrate some of its operations from the 137.1850-137.2375 sub-bands to as many as two of the NOAA channels, specifically the 137.485-137.515 MHz and 137.605-137.635 MHz channels. Thus, any proposals by the second round applicants to use the 137-138 band should contemplate the use of as few as two of the NOAA channels, specifically the 137.333-137.367 MHz and 137.753-137.787 MHz channels. We believe that two channels coupled with the use of the band edge is sufficient spectrum for a Little LEO system to operate. However,

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42 See Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed Satellite Service and the Mobile Satellite Service for Low-Earth Orbiting Satellites, Report and Order, 8 F.C.C. Rcd. 1812 (1993).

43 HETE, a one satellite, non-geostationary U.S. satellite system, plans to use the 137.955-137.965 MHz band and is scheduled to launch in November 1996.

44 Each operational NOAA satellite is assigned two of the four frequencies, but we understand that NOAA does not have any plans to implement any frequency changes to its operational satellites.

45 Space operation, meteorological satellite, space research, and mobile satellite service systems can all operate on a primary basis in the 137.0-137.025 MHz frequency segment. See 47 C.F.R. § 2.106, Footnote US244.

we do ask for comments on whether this spectrum is sufficient to support a system.

54. Consequently, a Little LEO system would have use of the NOAA bands until the year 2003 and time-shared use of the available NOAA channels from the year 2000 and the NOAA bands from 2003. When NOAA's satellites in the NOAA channels become inoperable, the Little LEO licensee could use the channels on a primary, full-time basis. Further, subject to coordination with the Executive Branch, specifically NTIA and NOAA, a Little LEO system could continue to time-share the NOAA bands with NOAA satellites on a secondary basis.[46]

55. The implementation of NOAA's system in the NOAA bands could work as follows: Little LEO System-2 could begin operating in the NOAA bands and work with NOAA to migrate Little LEO service to the NOAA channels after the year 2000. After the year 2000, Little LEO System-2 could time-share the available NOAA channels until NOAA's two satellites become inoperable. Since the NOAA system currently has two operational satellites in the NOAA channels and will continue to operate them until they become inoperable, we anticipate the Little LEO licensee would be able to use the NOAA channels for 89.8 percent of the time.[47] However, during NOAA's implementation of its satellites in the NOAA bands, Little LEO System-2 would have to time-share both the NOAA channels and bands with NOAA's system. During this period, the Little LEO system would operate on a secondary basis to NOAA's system in the NOAA bands. We calculate that the licensee would be able to use the NOAA bands for 84.5 percent of the time.[48] Once NOAA has vacated the channels and implemented

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[46] Ongoing studies in the International Telecommunication Union - Radiocommunication Sector ("ITU-R") indicate that sharing between MSS downlinks and MetSats at 137-138 MHz can be accomplished by using co-frequency avoidance in the same geographic area. See "Modification to Attachment 21; Report of the Fifth Meeting of ITU-R Working Party 8D" (Geneva 13-22 March 1996) at § 4.1.1.1.5.

[47] This calculation is based on the operation of two satellites by NOAA with an earth station having an elevation angle towards the satellite of 0 degrees and for a user located in the Washington, D.C. area. Currently, NOAA's two satellites are phased in the orbital planes and each utilizes two of the four channels to provide meteorological satellite service. Consequently, we also anticipate that Little LEO System-2 would be able to use one of the two channels for 94.9 percent of the time.

As stated previously, the availability of the satellite to the user is, in part, a function of the location of the user. For example, NOAA's two satellites will be available to its users located at latitudes of 0, 30, and 60 degrees for 92.4, 90.8, and 81.6 percent of the time, respectively. For calculations based on the operation of four satellites, see paragraph 70.

[48] This calculation is based on the operation of three satellites by NOAA with an elevation angle of zero degrees. The availability of NOAA's system to its users will increase if NOAA increases the number of satellites in its system from two to three. This in turn will diminish the availability of the Little LEO system to its users. As previously stated, the Little LEO licensee will need to coordinate its system with other users of the NOAA bands.

its system at the band-edge, the Little LEO licensee could continue to time-share and operate on a secondary basis to NOAA in the NOAA bands. [49] However, a Little LEO licensee would have primary use of the NOAA channels when NOAA's satellites become inoperable.

ii. Time-Sharing with NOAA

56. In bands shared by Little LEO system-2 and NOAA, time-sharing offers complex but effective technique for maximizing the use of orbital and spectrum resources. In order to time-share effectively and avoid transmitting signals that interfere with the NOAA earth stations' receipt of transmissions from NOAA satellites, each Little LEO satellite must "know" its position relative to each NOAA satellite and be able to shut-off operations when necessary.

57. To ensure that NOAA earth stations[50] do not experience harmful interference from Little LEO downlink signals, we propose to require that Little LEO satellites not transmit into the region beneath the NOAA satellite, the "protection area," on the frequency used by that NOAA satellite.[51] As a NOAA satellite progresses along its orbit, its protection area will move across the surface of the Earth beneath it. The Little LEO satellites following their orbits must track these moving NOAA protection areas and shut-off their transmissions if they enter any NOAA protection area worldwide.

58. By using precision information concerning the location of the NOAA satellite, Little LEO satellites can avoid interference to NOAA earth stations. The precision information needed includes ephemeris data, which consists of spacecraft orbital parameters,[52] the elevation angle of the NOAA satellite, and the frequency on which the NOAA satellite is operating.[53] This

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Other Administrations plan to use the NOAA bands and this may affect the time available for use by a Little LEO system.

[49] The availability of NOAA's system to its users will increase if NOAA increases the number of satellites in its system from two to three. This in turn will diminish the availability of the Little LEO system to its users.

[50] The term "NOAA earth stations" as used herein refers to all earth stations (including DoD earth stations) receiving NOAA signals regardless of whether or not they are operated by NOAA.

[51] See Section 25.257, Appendix B.

[52] Ephemeris data are technical parameters calculated for a particular satellite that mathematically represent the location of the satellite in its orbit at any given time.

[53] The elevation angle is the angular height of the satellite above the horizon as viewed from a point on the Earth. As used herein, the elevation angle is the angle, as measured from a NOAA satellite receiving location on the Earth, upward to a passing NOAA satellite. If the passing NOAA satellite is at the horizon the

information can be used by the Little LEO satellites (which have their own ephemeris data) to determine the location of the NOAA satellite protection areas at all times.

59. In order to ensure that the Little LEO satellite can accurately locate the protection areas of the NOAA satellites, updated information must be provided periodically to the Little LEO operator. The gravitational forces of the Sun and Moon, the non-spherical nature of the Earth, and atmospheric drag affect satellite locations, thereby slightly altering the relevant ephemeris data over time. Thus, Little LEO systems must be capable of generating timing sequences to coordinate properly the termination of transmissions when their satellites are within sight of a protection area, and the satellites must be capable of receiving the instructions necessary to implement their timing sequence from their gateway Earth stations. In order to ensure that the necessary information is uploaded to the Little LEO satellites frequently enough to prevent accumulation of erroneous data that may lead to incorrectly identifying NOAA protection areas, we propose to require that the Little LEO licensee obtain updated ephemeris data from NOAA and upload the updated ephemeris data to its satellites on at least a weekly basis or as often as necessary to avoid interference.[54] We seek comment on the appropriateness of this requirement.

60. We also propose to require Little LEO operators to identify a point of contact accessible twenty-four hours a day, so that anomalies or reports of interference while time-sharing can be addressed expeditiously.[55] We ask interested parties to comment on the preferred means of transferring ephemeris data to the Little LEO operators, e.g., via electronic transfer or by diskette. We also ask for comment on the procedures to be undertaken in the event of unavailability of the data or observed errors, and similar matters.

61. To minimize the likelihood and extent of interference to NOAA earth stations, we propose that Little LEO systems use a zero degree elevation angle when calculating the location of NOAA's protection area. This assumes that the NOAA receiver is at an Earth location which can see a Little LEO satellite at the horizon. In some cases, of course, a Little LEO satellite would not be visible until it is a few degrees higher than the horizon, due to buildings, trees, etc. In some environments, such as on large bodies of water, zero degrees represents a reasonable approximation. In general, we believe an elevation angle of zero degrees should be sufficient to protect NOAA earth stations from Little LEO satellite transmissions. At this angle

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elevation angle is zero degrees. If the NOAA satellite is directly overhead the elevation angle is 90 degrees.

[54] See Section 25.257(a), Appendix B.

[55] See Section 25.257(b), Appendix B.

there will be very little radio energy received by a NOAA receiver from a Little LEO satellite. We request comments on the use of a zero degree elevation angle.

62. In some cases, NOAA and Little LEO satellites may be so far apart that the Little LEO satellite transmissions will not overlap with the protection area beneath the NOAA satellite. Under these circumstances, there is little possibility the Little LEO satellites will interfere with the NOAA earth station's receipt of transmissions from the NOAA satellite. For smaller separations, however, the Little LEO satellite will impose sufficiently strong signals into the NOAA protection area potentially causing harmful interference. If notified that this interference is occurring, we propose to require that the Little LEO transmitter be shut-off.

63. As a further step to assure that interference to the NOAA system is minimized, we are proposing Section 25.257(c) that will require a Little LEO satellite to automatically cease transmissions in the 137-138 MHz band if the satellite does not receive a valid reset signal from a Little LEO gateway station within forty-eight hours. Thus, if a Little LEO satellite were to malfunction and transmit into a NOAA protection area, the potential damage would be limited by the automatic shutdown feature. We have selected forty-eight hours as the reset period for this protective protocol, based on what we believe to be the reasonable period of accessibility to all Little LEO satellites from a given gateway Earth station. However, it is quite possible that less than 12 hours is feasible, particularly if there are several gateway Earth stations located worldwide. Part of the reset protocol may require confirmation or validation that the Little LEO satellite is functioning properly. Otherwise, resetting would simply perpetuate rogue transmissions. We ask interested parties to comment on the necessity of this reset capability, the need for and characteristics of a validation mechanism, and our proposal for a forty-eight hour reset period.

64. Finally, we seek comment on the effect of this time-sharing proposal on the NOAA community. NOAA earth stations, scattered throughout the world, will "see" the Little LEO co-frequency transmissions for extended periods of time when those receivers are not receiving a NOAA signal. The respective technical features of the NOAA and Little LEO radio transmissions should prevent NOAA earth stations from experiencing any significant adverse impact. However, there may be circumstances or particular equipment designs that cannot achieve that signal differentiation and will be adversely affected. We ask for details concerning any such circumstances or equipment, and recommendations on how to ameliorate any adverse impact to the time-sharing technique we are proposing.

65. In order to facilitate interference-free operations, prior to the launch and operation of a licensed system, we propose to require that the Little LEO licensee successfully coordinate its system with NOAA. In addition, we request comment on our proposed sharing and migration scenario between Little LEO System-2 and the MetSats. Parties should specifically address how

the NOAA channels and the band-edge sub-bands can be used most effectively by a new Little LEO entrant or entrants. We ask interested parties to include detailed discussion of their technical plans sufficient to demonstrate that there will be no unacceptable interference to the NOAA system operating in the 137-138 MHz band. We ask parties to comment on how sharing with a NOAA system consisting of two satellites operating in the NOAA channels and three satellites operating in the NOAA bands can be accomplished in the 137-138 MHz band. Specifically, parties should address whether time-sharing of frequency blocks is feasible (e.g., how time should be restricted, the effect on service to consumers, the impact on interference), and if so, how these blocks should be licensed. Further, parties should address whether more than one entrant's downlinks can be accommodated in this band.

iii. Other Users of the Band

66. In addition to NOAA's use, Orbcomm uses a range of channels in the 137-138 MHz band employing FDMA modulation techniques.[56] Starsys is expected to use essentially the entire 137-138 MHz band by employing spread spectrum multiple access ("SSMA") modulation techniques. France's S80-1 Little LEO system plans to operate in this spectrum and will use SSMA across most of the band. Russian's METEOR system will also operate in this band. At least three Little LEO systems, Orbcomm, Starsys, and S80-1, anticipate operating twenty-four hours a day and will have essentially full geographic coverage.

67. Nevertheless, we believe that at least one additional system can be accommodated in the 137-138 MHz band through time-sharing techniques. As noted, both Orbcomm and Starsys have represented that an additional Little LEO entrant can share their authorized spectrum. We also believe that the scheduled MetSat migration will relieve congestion in certain channels, freeing spectrum for a new Little LEO entrant.

3. Little LEO System-3 (149.95-150.05 MHz/400.150-400.5050 MHz/400.645-401.0 MHz)

68. The spectrum we are proposing for use by Little LEO System-3, the 149.95-150.05 MHz (uplink) and 400.150-400.5050 and 400.645-401.0 MHz (downlink) bands, are not currently licensed to Little LEO systems. The uplink band is used for radionavigation-satellite service (RNSS) systems, while the downlink bands are authorized for use by the DoD.

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[56] See Orbcomm Application for Modification of License, Application, File No. 5-SAT-ML-96, (dated October 18, 1995). By its modification which is pending before the Commission, Orbcomm proposes adjusting its frequencies in the 137-138 MHz band, among other reasons, to be compatible with Russia's METEOR system. Coordination of Orbcomm's modification to facilitate operation with France's planned S80-1 system has not been completed internationally.

69. In coordinating the three licensed Little LEO systems with France, the 149.95-150.0 MHz and 150.0-150.05 MHz band segments have been earmarked for use by U.S. Little LEO systems. Nevertheless, we still need to re-coordinate use with France in the future. We believe that, together, these two 50 kHz segments can accommodate one system. The licensee would need to develop sharing arrangements and coordinate with existing RNSS use by a U.S. and a Russian system. We believe, however, that sharing arrangements should not prove unduly difficult because we expect the United States RNSS system to vacate this band in the near future. We request comment on the sharing potential with RNSS systems in this band. We also request comment on whether multiple "small" networks might be accommodated in this band. Those who favor a multiple system approach should address spectrum sharing, inter-system coordination and interference avoidance.

70. With respect to our proposed downlink band for Little LEO System-3, DoD is authorized to use the 400.150-400.5050 MHz and 400.645-401.0 MHz band.[57] Our understanding is that DoD plans to operate a satellite system worldwide that will consist of up to five satellites in the 400.15-401.00 MHz frequency band. We estimate that a DoD user in Washington D.C. would have access to a DoD three-satellite system for approximately 15.5 percent of the time.[58] The remaining 84.5 percent of available time, or about twenty hours per day, could be used by Little LEO System-3. A DoD user at 0, 30, and 60 degrees latitude would have access to a DoD four-satellite system for 15.2, 16.8, and 34.9 percent of the time, respectively. For a five satellite system, the time availability will be proportionally higher for a DoD user. We request comment on how the Little LEO system could best use the remaining available time based on a DoD system composed of five satellites.

71. The Little LEO System-3's ability to implement this time-sharing scheme is vital to the global national security interests of the United States. Therefore, it is important that licensees who share the 400.15-401 MHz band with DOD assign the highest priority to avoiding interference to DOD systems worldwide. We have proposed rules for the 137-138 MHz band which we believe will prevent harmful interference to current users. Those rules and the attendant discussion are also largely applicable to the 400.15-401 MHz band, where DOD operates its METSAT system. Based on concerns expressed by DOD, however, we request comment by interested parties on the feasibility of establishing a protection area in the 400.15-401 MHz band that extends below the horizon, *i.e.*, an elevation angle of less than zero degrees. Comments on this issue should include examination and analysis of the impact of elevation

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[57] As stated previously, all references to a system operated by DoD in the 400.15-401.0 MHz band incorporates, a system operated by DoD and any system merged with NOAA. The DoD system is expected to merge with the NOAA system.

[58] This is calculated using an elevation angle of 0 degrees.